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ABSTRACT

This report reviews and interprets activities carried out at the Center for Studies in Education and Development, Harvard Graduate School of Education, in support of the Information System for Vocational Decisions (ISVD) over a three year period. Included here are the contents, development, use so far, and potential of three specific datafiles within the system: (1) the Occupational Title File; (2) the Occupational Groups Datafile; and (3) the Military Datafile. The current limitations of the system are acknowledged. Besides the development and use of the three datafiles, the report also covers forecasts for two kinds of datafiles and discusses possible development of other datafiles and extensions of the existing ones. In each case the history of the work carried out during the Project is described and explained; its final results are presented; and suggestions are made for further development. (Author/TL)

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INFORMATION SYSTEM FOR VOCATIONAL DECISIONS

Project Report No. 24

A FINAL REPORT ON FORECASTS AND DATAFILES

PREPARED FOR

THE INFORMATION SYSTEM FOR VOCATIONAL DECISIONS

BY

THE CENTER FOR STUDIES IN EDUCATION AND DEVELOPMENT

Richard M. Durstine

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CHAPTER 1

SUMMARY

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Introduction

This report reviews and interprets activities carried out at the Center for Studies in Education and Development, Harvard Graduate School of Education, in support of the Information System for Vocational Decisions (ISVD) over the three year period June, 1966, through August, 1969. Since this report is centered about the activities of a particular group of participants rather than around the formal organization of the Project as given in its Quarterly Reports, the structure here is somewhat different from that of the reports. It covers the material summarized in them under the headings:

"Forecasting and Associated Data File";

"Occupational Alternatives and Associated Data File";

"Military Alternatives and Associated Data File".

Included here will be the contents, development, use so far, and future potential of the above three datafiles, with emphasis on past accomplishments and the conclusions that can be drawn from them. On the basis of experience so far, numerous suggestions arise as to what could and should be done were the ISVD to continue into a further developmental stage. Some of these suggestions relate to specific datafiles; more usually they relate to the creation and use of datafiles generally; and sometimes they apply to the Project as a whole.

Throughout this report an attempt is made to keep suggestions to those that are feasible based on experience and technology now existing in the Project. The suggestions are thus meant to be realistic and practical ones, though often they are expensive in terms of the effort they would involve.

In reading this report, the reader is cautioned that not all the decisions made and actions taken in the Project were as explicit and conscious as might appear in retrospect. Much of what we did was exploratory. Much of it would be done differently a second time.

Likewise, it is well to remember that the results seen here relate to a system in its developmental stages. We are still in the midst of an evolutionary process. Much of the groundwork laid so far has not been fully tested or put to use. We believe that the next steps, if they take place, will be easier because of that groundwork. The extent to which that is true has yet to be seen.

Lessons Learned and Questions Raised

What we see in the datafiles as developed so far are examples of what might have been done. Details of and inferences from these examples will be found in this report. In general we have discovered a wide field of possibilities in collecting, combining, and presenting facts for delivery by computer. We have also seen that it is unfeasible to do everything by computer. It is also an open point how much it is possible to make the computer communicate as a person does; and given that possibility, there is the question of how desirable it is to do so.

From an operational point of view, the feasibility of the approach used in this Project is seen not only in the technical results, but also in the relative ease with which it was possible to train coders of facts, and writers of scripts to deliver those facts. Most of the work described here was done by initially inexperienced persons, who developed rapidly in the job to mastery of its specifics.

The complicated nature of the total task, and the need for it to articulate well with a variety of other activities, has emphasized the importance of modular design for the working system. It is necessary to be able to add, delete, or change parts of the system without crippling its operation as a whole. In other terms, we have learned we must seek a "kit" for system design. The details found in this report must thus be thought of as examples, not as a unique product.

The datafiles described here, as collected and used so far by the ISVD, are reasonably limited in their quantity and scope. They do not compare with the contents of even a small library. Their interest and strength lie in the flexibility and rapidity possible for their use; and their capacity for cross-referencing among themselves, and with outside sources.

The major questions that have been addressed in our exploratory investigation, creation, and use of datafiles are: the feasibility of the approach used; when the computer is a useful tool for this approach, and when it is not; and the desirable sequence for future development. The answers to each of these questions are complex, and cannot be given in summary form. To some extent they are given throughout this report. To some extent they are not yet available.

Structure of This Report

This report covers development and use of datafiles of three kinds (Chapter 3) and forecasts for two kinds (Chapter 5). It also, in Chapter 4, discusses possible development of other datafiles, and extensions of the existing ones. In each case the history of the work carried out during the Project is described and explained; its final results are given and

discussed; and suggestions are made for future further development.

Much relevant information is not included directly here, but resides in the archives, Project Reports, and Technical Memoranda of the ISVD. These are referred to as appropriate in the course of the report.

CHAPTER 2

CONCLUSIONS AND SUGGESTIONS

CONCLUSIONS AND SUGGESTIONS

General Outlook

This chapter belongs logically at the end of the report. Its position as Chapter 2 is designed to give it prominence.

Many thoughts and suggestions appear throughout this report. I hope and believe they are consistent among themselves, though occasionally they may prove repetitious, since the same suggestion sometimes arises from more than one experience.

This chapter will not attempt to collect or to summarize those many suggestions. They are too extensive and complex for that. Rather the discussion here will dwell on some broader issues that have arisen during the course of the Project, and which deserve attention in an evaluative report such as this one.

As elsewhere in the ISVD Project, the attempts made at development and use of occupational information were primarily to determine the feasibility of various approaches and methods. As any study of feasibility, this one tends to be ambitious. It would not be proper otherwise. An effort at producing a working system for regular operation, on the other hand, would have different guidelines. A far more conservative approach would be appropriate. But here the purpose was to try things, some of which would not work, or which would be impractical in an operational situation. This report tells of the results of those trials; it assesses their applicability to an operational system; and it indicates what developments would be needed to extend the present work into an operational phase.

To the extent that it has been observed in operation so far, the computer-based interactive system shows frailties of several kinds:

1. Technical problems of a shallow nature. These include errors in coding or in recording information, and those things called "bugs" by computer people. Though faults of this kind can be annoying, and can mar a demonstration, they are essentially easy to fix, given sufficient time and patience. They are analogous to spelling or grammatical errors in a manuscript.
2. Technical problems of a deep nature. These are not so much errors as indications of where technology has not yet caught up with aspirations. Limitations on storage space, delays in response, and inability to carry out certain kinds of logical operations fall under this heading. Sometimes these failings can be relieved with further development of logic or of "software". Sometimes they mean that expectations must be reduced for the time being.
3. Simple but costly problems. Problems of data gathering are often of this kind. Up to a point, gathering more and better data, keeping it current, and selecting and presenting it to the user in an attractive and clear manner are a matter of a lot of careful work. This is the kind of problem that can be solved with other aspects of the system.
4. Conceptual problems and dilemmas. These are the interesting ones. How to deal with highly unstructured, variable, or ill-defined facts? How to choose between directiveness and non-directiveness in presenting facts? How to choose between summary and thoroughness? How to choose among a host of ways of selecting material for presentation? These are the problems of design whose solutions give the system its personality.

> They are the problems that have no single answer, but which can lead to a variety of realizations of the working system, each with its strengths, weaknesses, and uses.

A couple more dilemmas can be added to item 4. One is the choice between delivering facts directly, and extending the interaction between system and user to check for his preference and draw out his reasons. There is a time and a place for each sort of delivery. A second choice is between terseness and chattiness in delivery. Terseness may seem forbidding, but a garrulous computer can be very trying. There are other pairs of choices that will also arise in design of an interactive system for guidance -- or for anything else. Those named here give an idea of the kind that have come to mind in preparation and use of datafiles about occupations and military careers. They are, and will remain, some of the more interesting questions of system design.

Observations on the Operating System as It Stands

All those who worked in the design and creation of the ISVD working system awaited the product with excitement and anticipation. It is probably not unfair to say that the reaction when the system became operational was one of excitement mingled with disappointment. Though we recognized the experimental nature of what we had done, and on paper were able to look at it in a detached and analytical way, the system often did not live up to what we had hoped it would be. The disappointment was the worse because often we knew what could be done to improve its performance. We yearned to correct things; to change things that had been done months before; to tinker and made improvements that we knew to be within our reach. But

these improvements take time and specialized skills, both of which were limited.

But the sense of disappointment was, to an extent, illusory. A sound groundwork has been laid for a more complex working system than the one we now have. Many of the problems that pain us most are of a minor nature, and could readily be fixed given the resources to do so. In addition, we know how to do a lot of things we have not yet done, and the technical basis exists there to do them. In sum, the foundation that has been laid appears to be a firm one. The weaknesses that are present can be taken as points for development.

Below some of the problems and opportunities involved in improving and extending the system to its full potential will be outlined. The comments here relate particularly to datafiles, since they are the topic of this report. Some of the more general things that must be taken into account are:

1. There is no single best answer to the problem of design and use of datafiles. Several alternatives should ultimately be available, to be used as needed, and to be linked to one another by suitable referencing procedures.
2. As an example of the above point, there are many ways to sort data in response to the requests of a user ("inquirer") of the system. As he, through use of a "preference script", expresses his needs, likes, and dislikes, the system decides how to respond to him through a somewhat elaborate sorting of the material in its files. The logic of this sorting depends in part on how strictly we wish to observe the suggestions given by the user. One such logic has been tried so far, one

that was thought to be loose and permissive, but which in fact eliminates alternatives very rapidly. Other alternatives for sorting ought thus to be tried, and all ought to be kept available for use when appropriate.

3. The language the system uses in communicating with its users has always been a subject of discussion. Should the system try to communicate in English? Should it try to understand English? Should it say "I" or "Good Morning"? Let me add another opinion to this discussion. Surely the system should be made to communicate as clearly and as precisely as is feasible. But the faking of human conversation, though tempting, is a questionable enterprise. The system is not human and will never be. The goal to be sought is to <u>individualize</u> the system's relation with the user, not to "humanize" it. This means a firm effort to have the system understand the user's needs, in whatever language he can be persuaded to use; and to respond in a way that the user can understand. It need not be the language people use when speaking to one another.

4. The question of when to use a computer to communicate with an inquirer of the system, and when to try other means (say, books, or a counselor) is another item for careful attention. Since the ISVD has been a computer-based effort, and since we were engaged in learning the feasibility and limits of a computer-based interaction, this sort of question was not in the forefront during the course of the Project. A look backward tells us that wise use of other means could augment the system. There are, however, areas in which the computer clearly excels. Some of them are:

   a. in making a product tailored to the individual user; giving him only what he needs at the time of his inquiry; guiding him through masses of data without saturating him;

b. for speed of response in delivery of information, whenever that may be important;

c. for rapid addition, deletion, or alteration of information;

d. to facilitate complicated processing and cross referencing;

e. to create new and personalized files through combination of the information in the system's files with that presented by (or for) the inquirer;

f. to "wow" the user; an aim that may sound undignified, but one that may, sadly, be necessary to engage the inquirer in the process and problems of his career choice.

Means of presentation other than the computer are likely to be preferable when the inquirer is involved in:

a. finding details;

b. clarification of his ideas;

c. intentsive study.

Selection, Gathering, and Presentation of Data

In this section the points made above will be supported and emphasized as they relate to the gathering and use of data, with particular attention to that on occupations. There are two kinds of issues that arise here: technical issues, as content and accuracy of information, and rules for sorting it; and stylistic issues, as form and language of presentation. These are both subordinate to the central task of providing a link between data about the "outside world" and the personal datafile that the inquirer carries, unknowingly perhaps, within himself.

The interactions between datafile and inquirer places heavy requirements on each. The user must be prepared to search what he knows of himself,

and to relate it to what the system has to offer from its files of data. The system must relate the content and structure of its files to the needs it senses from the user. The system, fully developed, would take into account the content, form, and sequence of these requests. The result, in an ideal case, would be an elaborate conversation between the system and its user. This conversation would not be predetermined, but would have a structure provided partly by the user and partly by the system. This is a complicated aim, and one we have not yet achieved. Nor could we ever achieve it fully. But the tools have been prepared and tested for a substantial move toward that achievement.

To whatever extent such a conversation between inquirer and system is achieved, it is the inquirer's responsibility to relate himself to the data so as to make a well-founded and profitable choice for himself. This choice will depend on three groups of factors:

1. Those natural characteristics of the user which he can alter only slightly if at all. His aptitudes (as general intelligence, verbal ability, manual dexterity) and physical characteristics (as strength, agility) would be included here. For the most part he must seek occupations that make demands within his profile of natural abilities. Some stretching of this profile is of course possible, as can be seen in exceptional cases, but for the most part it provides a good first outline of limits on the user's present occupational possibilities. On the other side, the inquirer will generally seek an occupation that fully uses at least some of his abilities. This is a complicated issue, and one that could lead to extensive research.

2. Those personal characteristics that can be changed. Education and training are the most important here. Some attitudes, and other individual characteristics, can enter as well. It is within these dimensions that the inquirer can change himself if he seeks to do something outside his present capabilities.
3. Characteristics of the occupation. These are what the job offers to -- and demands from -- the inquirer. Some of these characteristics might be changable, but for the most part must be considered fixed, at least during the user's period of choice.

The contents of the above three dimensions must be examined, verified, manipulated, and compared against alternatives by the inquirer, with the help of the system. This process will occupy the conversation between the two. It is the validity of this conversation that will determine the value of the datafiles to the user of the system.

So far only one such kind of "conversation" has been designed into the system and put to the test. One of its faults seems to be that it eliminates possibilities too fast. Other such conversations ("preference scripts") need to be designed and tried. Some of the variables that might be introduced are: scaling of the preferences of the user, either through their sequence, or through assigning them some kind of evaluative weight; provision of "next-best" alternatives as well as first choice selections; and more thorough explanation of the reasons for the suggestions made by the system.

In all its ramifications, the interaction suggested above can be very lengthy. It must thus be designed in a way that its part can be used or bypassed, depending on the needs of the user at the time.

Beneath the dynamic interaction between inquirer and system lies a great mass of technical material. Some relates to the computer and its use, and is outside the scope of this report. Some relates to the "scripts" that determine the form of presentation of the facts that reside in the system. And some relates to the information itself, to the "datafiles" that are the primary subject of this report (though the subject of their use brings us also into partial consideration of certain kinds of scripts.

The details of some datafiles of the ISVD will be discussed in subsequent chapters. Comments of a more general nature on the subject of datafiles are found in ISVD Project Report No. 15, "Datafiles for Computerized Vocational Guidance: Requirements, Preparation, Use", by Richard Durstine. Included there are the points

1. Datafiles should be designed primarily to serve the uses and needs of individuals.
2. The operating system can only tell (and rearrange) what it has been told previously.
3. The cost of gathering information directly makes it necessary to use ready-made sources (e.g., statistics tabulated by government agencies), primarily if not exclusively.
4. It is necessary to articulate the contents of various sources which are related but not directly compatible. Otherwise it will not be possible to put to full use the facts that are available.
5. The use of facts from the datafiles should be suggestive and guiding, not prescriptive.
6. Flexibility of use of datafiles results in part from the rigidity of their structure.

In Chapter 3 of the present report, the conceptual form of the datafiles of the ISVD will be described. This form puts data into a rectangular array, listing along one side categories for which the data are kept (e.g., names of occupations); and along the other, the topics of the data, arranged in a predetermined and highly structured way. The data are delivered to the user through use of a "template" or standard form into which the data for the chosen category ("record") are put. A full description of this process, with examples, is found in Chapter 3. The reason for reviewing it briefly here is to introduce a list of advantages of this form of treatment:

1. Economy of storage, through use of numerical codes, to abbreviate lengthy items.
2. Easy addition (or deletion) of records.
3. Easy alteration of information within the datafile, either in detail or across all records.
4. Possibility of using a variety of languages in presenting the data without changing the data itself. This variety might be desirable because of the user's reading ability, because of the nature of his inquiry, or simply to alleviate the boredom of a repetitive format.

Selection of data for use is a difficult problem. It must to a large extent depend on what is available, as a matter of simple economics. One of the advantages of a highly structured datafile is the chance to exploit and combine facts from a variety of sources. On the other hand it is important not to sanctify crude or incorrect information through uncritical or unqualified use. Thus in selection of data it is necessary to consider:

its validity,

its cost,

its currency (up-to-dateness),

the locality or other special situation to which it refers,

the ease with which it can be related to other data.

Further on the subject of choice of data, "completeness" is sometimes mentioned. This is a tricky topic. Clearly if information is left out, the datafile is incomplete. But what if that information is very specialized, or only partially correct? What if it might better be provided in a form other than a computerized datafile? What if it is likely to be very little used, or poorly understood by the user? Completeness of inclusion of data must be based on a balance of their availability, validity, and potential usefulness.

One source of incompleteness is the inclusion of facts for certain cases that are not included for others. We may know more of the wages of one occupation than of another. If we include the known wages, the lack of that information for the other occupation is all the more evident. Partly, this can be made palatable by graceful presentation. But "holes" in the data will always be evident because the facts are not available to fill those holes.

What sort of working arrangement is needed to create and maintain useable and trustworthy datafiles? It is easy to see that a fully complete and reliable set of datafiles is an operational impossibility. In addition, facts tend to get quickly out of date, and need frequent checking and revision if their validity is to be maintained. This is not so much a research and development job (though it is a part) as it is one of production. Such

an effort was not a proper part of the ISVD Project. Whenever the step toward a working operational system is taken, however, provision must be made for production and maintenance of datafiles on a regular basis.

Priorities, Possibilities, and Recommendations

The above discussion is lengthy and involved because it addresses a complex topic. The following chapters are no less complicated. The closer one gets to the specifics of operation the more complicated they become. In this final section of general discussion, therefore, a few central issues of datafiles in the ISVD will be reviewed briefly.

Most important, we seek to tell the inquirer what he needs to know, in a form that is useful to him. This effort is limited by what he wants -- or thinks he wants -- to know, by his ability to absorb and use facts, and by the nature of the facts the system has available. Often he wants to know difficult things -- fleeting, personal things; he wants advice when none other than himself can provide it. Because of this, no information system can ever live up to all that might be expected of it. Likewise, many facts are expensive both to gather and deliver to the user, because of the complexity of his needs. Thus many decisions necessary to development of datafiles are basically economic, in that their sequence and level of effort must be chosen in response to demands beyond the ability to supply.

To meet this challenge, should the concept of the ISVD be continued, staff to carry out the following functions would be needed:

1. to scan new sources and decide what facts to include in the datafiles, and in what form;
2. to record these facts, and assure their delivery in a form suitable for use by the operating system;

3. to gather special information, and develop new sources of information, as needed and as economically feasible;
4. to develop the logic and language of scripts needed to select and deliver facts from the system to the user;
5. to integrate and articulate all this within itself and with other parts of the system.

In the making of datafiles and of scripts to go with them, development is particularly needed in:

1. better referencing among files;
2. better linking of scripts to files;
3. specialization of scripts and language to take into account:
   a. the kind of "discontinuity" being faced by the inquirer,
   b. the stage at which he finds himself getting through that discontinuity,
   c. the level of language he can (or cares to) deal with,
   d. the local or other special situation within which he is working.

One important related problem, much in need of careful attention, is that of "career trees". This is of particular importance in the use of occupational information by individuals (as contrasted with its used by industry, educational institutions, or government), since decisions are better made in terms of a pattern in time than step by step. Possible definitions of career trees ("career sequences" might be a better term) were studied by Stephen Purcell in summer, 1967. His work provided better understanding of problems that need to be overcome to get helpful information on how individual jobs tie together into careers. For one thing, only past information can ever be available, and it is information about future opportunities that needs to be delivered. Next, since the number of

possible sequences is immense, only the more likely ones can be considered. More fundamentally, discussing career sequences as though they were known and fixed, tends to foster rigidity of planning, where we should be seeking freedom of choice and of movement. In all, it is not a very encouraging picture.

A recent article by Thompson, Avery, and Carleson suggests a structure that might be helpful, and which could be related to the kind of occupational data we know to be available to the ISVD. The authors base their work on three dimensions: the individual, the organization, and time. The individual in his career tends to move from exploration to stability, and to base his decisions either on occupational aspirations, organizational aspirations, or both. Occupations are seen in a structure depending on whether the worker reaches his "ceiling" early or late in his career, and on whether his standing in the job is determined by ones colleagues (as in the professions) or by the enterprise in which one works. These dimensions seem promising ones for further investigation of career sequences.

CHAPTER 3

THREE DATAFILES OF THE ISVD

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General Summary

In the development of the ISVD datafiles have played an important role in both an operational and a conceptual sense. This chapter will deal with their operational role through description of three of the datafiles that have come to be in the course of the Project. The three datafiles are:

1. The Occupational Title File (also called "850 Title File", "853 File", and similar names during the course of the Project), which brings together facts on some 850 occupations listed by title.
2. The Occupational Groups Datafile (sometimes also called "Groups File"), which contains data listed according to a set of occupational groups that cover the entire labor force.
3. The Military Datafile, which covers career alternatives for both officers and enlisted men in the Armed Forces.

The above are not all the datafiles prepared for the ISVD, but for reasons of authorship they are the ones that receive attention here. This account of their development and consequences should serve to suggest many of the issues that arise in creation and use of datafiles generally.

The discussion here will cover historical development of the above three files, preparations for their use, and their delivery to the technical process of inclusion in the working system of the ISVD. Again for reasons of authorship, modifications which occurred after that cannot be discussed here. Therefore, users of computer terminals of the ISVD see evidences of datafiles similar to, but different in detail from, those discussed here. Some of the observed changes arose from technical necessity; some are editorial improvements made during implementation of the files for presentation

by computer; and some are things that have yet to be ironed out in future development of the system.

Because many technical details of the files have been changed in their development, and because these details are quite lengthy, a full description of the datafiles will not be attempted here. Examples and illustrations will be used instead for the sake of brevity and clarity. Full descriptions are preserved in the Technical Memoranda, Project Reports, working papers, and other archives of the Project, and will be referred to as appropriate in this discussion.

Each datafile of the ISVD includes some, if not all, the features defined below. The nature of these features in each case defines the individual datafiles. The technical treatement of some of these ideas for use by the system is somewhat different from that expressed here; though the two are generally compatible.

Records - These identify sets of data within the file, usually grouped by topic. Thus in a datafile of occupations, each occupation listed, along with the information about that occupation, makes up a record. In a datafile of colleges, the information about each individual college would make up a record. The concept of "record" is meant to serve as a tool for describing and manipulating the information within a datafile. It should be treated as an aid and not a limitation to that process.

Fields - These are the subdivisions of a record. They break the record into topics of information. For conceptual purposes it is handy to have each record contain the same set of fields. One field in an occupation datafile might be "expected annual income". Another might be "minimum required education". Some fields might include more than one

entry, as "high school courses suggested". In certain records, some fields might be blank for lack of information, or for lack of relevance to the particular record. In preparing a datafile, it is convenient to think of the fields as lined up in columns alongside the names (or numbers) identifying each record.

Templates - Since the information within a datafile is highly condensed (for reasons of economy), it needs to be displayed in an expanded and palatable form if it is to be readily available to a "user" or "inquirer" of the file. Templates are a means for doing this. The template might convert the facts in the file to sentences, lists, tables, or even graphs or pictures. Not all of these forms of delivery have yet been attempted. In most, if not all, cases so far the template has served to convert the data of the chosen field to a sentence. It is this sentence, not the actual contents of the field, that is shown to the user.

Decode lists - These are the link between the material stored in the datafile and the presentation made by the template. The decode lists associate each possible content of a given field with the thing that will be displayed to the user. Sometimes this is a full sentence or other complete expression of the information. Sometimes it is a word that will fill in a blank space provided for it by the template (e.g., "Today is X". If the relevant field contains a "1", insert "Sunday" for "X"; if a "2", insert "Monday", etc.). The decode lists should include instructions in case the field is blank; and in case by error the field contains something that is not allowed by the decode list. This serves as a safety valve to indicate when mistakes need to be

corrected; and to reduce the probability of the template dishing out nonsense to the user (a very real possibility as users of the working system will attest).

Level 1 Records - These are a special device that "point to" (i.e., identify) records that have certain characteristics. A given level one record might for example, indicate all those occupations that require a bachelor's degree. Combining two level one records might then allow us to find which occupations require a bachelor's degree and also a lot of outdoor work. Thus level one records are a technical trick that allow withdrawal of information from the datafile without having to search through it in detail.

Preference Scripts - These are the outlines for a "conversation" between the datafile and the user to help the user select what he wants to know from the file. The preference script suggests to the user, usually in multiple choice form, certain of his personal preferences. These depend both on what the datafile contains (that is, on what kinds of queries it can in fact answer); and on what kind of choices the user is interested in making. The preference script makes use of level one records to select from the datafile the information the user has indicated he desires.

Interlinkings - These, though not yet much used by the ISVD so far, allow the datafiles to relate to one another, as an aid in making use of more than one datafile simultaneously. The means for this are quite simple. A field is included in the datafile that indicates what record or records (if any) of some other file bear a specified relation to the record of the original file. The information can readily be delivered

through the usual template form (e.g. "Examples of X are Y.", where X might be the record's name in the first file, and Y the related record names in the datafile being referred to.). References between any two files (or even within a datafile) are thus possible, so long as the relation is specific and consistent.

General Evaluation

The general outline and structure described above served, with minor modifications, in development and use of the three datafiles reported on later in this chapter. The experience of collecting information for these files, of preparing it for use, and to a lesser extent of seeing its realization in the working ISVD, have led to some general conclusions, as suggested briefly below. We have, in the course of our work, discovered things we would do differently if we had them to do again. We have discovered other things that are problems of a general nature, and which have no unique answers. Some of these are suggested briefly here in anticipation of the detailed accounts of this report.

It might be expected that many of the failings of the present datafiles could be relieved through better planning and design. This is only partly true. Under any working situation, most of the following limitations will almost surely be present:

1. Certain classes of information known to be desirable for inclusion in the file will not be available, or will be available only at great cost. This applies both to records (e.g., information on certain classes of occupations is often more abundant than for others); and to fields (e.g., reliable wage and salary information is hard to come by and to keep current).

2. Even when the desired records and fields are available for inclusion, certain specific combinations of them will not be possible to fill.
3. Sources of information will be of varying age, reliability, and detail. Combining them usefully into a single store of information is a tricky business.

Sometimes suggestions are made to collect information directly from the field, by interview or other type of survey. With reference to occupations, if such a survey were to concern a reasonably large number of occupations, with sufficient coverage of each to be confident that the information gathered was valid, the time (and hence cost) involved would be great, too great perhaps for all but the most affluent efforts at information gathering. This cost further increases when the cost of gathering information in the field has added to it that of preparing the information for use and retrieval by an information system.

It is also sometimes suggested that datafiles should go beyond the topics usually covered by standard sources -- to go beyond salary, for example, to "life style" or "self concept" of workers in a particular occupation. Interesting as such things would be, it is easy to see why the standard sources generally do not include them. Likewise these are not things one is strongly tempted to go to the field for when preparing a datafile under heavy temporal and budgetary limitations.

Another fault is often found with datafiles in terms of their accuracy and currency (up-to-dateness) -- or lack of them. These are further ramifications of the above two problems.

The above difficulties cannot be set aside just because their solutions are highly difficult. The makers of standard sources of information should

be encouraged to produce information in line with the needs of individual vocational decision-making. These standard sources, particularly those from the United States Department of Labor, are perhaps the only ones based on sufficient resources to meaningfully reduce the deficiencies suggested here. Even so, provision of really suitable information (speaking now particularly of occupational alternatives, though other areas of information are likely to be the same) will be a long, probably endless, evolutionary task. While waiting (and pushing) for improvements, we must continue to do as best we can with what we have.

If the above sounds pessimistic, it is not in fact meant to. There are plenty of interesting things to be done with existing sources of information, and there is plenty of exploration possible into the use of datafiles as they now exist.

Description of Three Datafiles

The remainder of this chapter is devoted to descriptions of three specific datafiles of the ISVD, with their associated templates, scripts, and interlinkings. The above evaluative comments apply in varying degree in all three cases, and generally will not be repeated.

THE OCCUPATIONAL TITLE FILE

This is the oldest and largest datafile of the ISVD, and is hence also most illustrative of their problems and shortcomings. It is made up of some 850 records, each associated with a single occupational title. In the selection of titles, an attempt was made to cover the entire labor force, with the exception of jobs requiring no skills (e.g., laboring jobs),

and those that are illegal. This attempt at coverage was reasonably successful, as can be seen in Appendix B, where the number of jobs from the Occupational Title File falling under each of some 160 larger occupational groups are shown. The detailed names and contents of the records of this datafile are preserved in the Project archives, as are many other items of information too lengthy for detailed inclusion in this report.

The fields of information covered by the Occupational Title Datafile are listed in Appendix A, along with a brief description of the contents possible in each field. A total of 1210 characters are allowed for each record, though these are never all used. Since much of the information included is highly condensed by the use of numerical codes, each record contains a considerable amount of information, though some of it is of questionable use or accuracy.

The Occupational Title File was prepared beginning the summer of 1966 under the direction of Russell Davis, Noel McGinn, and Laurence Wolff, who designed the form and specified the contents of the file. The roughly 850 records were coded by six casual employees hired for the purpose, using as principal sources the Occupational Outlook Handbook, Dictionary of Occupational Titles, Job Facts: 1966-67, Career Facts: 1966-67, Revised Minnesota Occupational Rating Scales, and the American Occupations Finder. The coded results were keypunched and checked for errors by Richard Durstine, Laurence Wolff, and Lynne Fitzhugh.

A review of the topics listed in Appendix A shows heavy dependence on the Dictionary of Occupational Titles (DOT). It was thus a great help when a magnetic tape record of information contained in the Supplement to the DOT became available through courtesy of the Bureau of Employment Security

of the U.S. Department of Labor. Included in the almost 14,000 records on the tape were all but three of the titles included in the Occupational Title File. The file as finally used by the ISVD was made up from the original file, information from the "DOT-Tape", and a few trimmings. This final version was prepared by Laurence Wolff, Lynne Fitzhugh, and Richard Truesdell.

The need to use this information in other than coded form, and to get access to it other than by title, led to creation of the first "template" and "preference script" of the ISVD. These concepts were described earlier in this chapter.

The original template, prepared by Laurence Wolff, is presented and described in pages 99-123 of ISVD Project Report No. 11, "A Rudimentary Demonstration for the Information System for Vocational Decisions." It was revised by Lynne Fitzhugh to provide greater interaction with, and control by, the user of the system; and was further revised for inclusion in the working system. The basic concept of the template remains as originally conceived, however: translation of coded information to words through "decode lists" applied to each field of the datafile; and sentence formats with blanks provided for the decoded words -- resulting in written English, though of somewhat wooden form.

The preference script, as first written by Richard Durstine and Lynne Fitzhugh, is shown on pages 45-98 of ISVD Project Report No. 11. This also has undergone several changes in its evolution from a composition on paper to a part of the working system. These changes have primarily been in the direction of brevity, and toward giving the user of the system a fuller idea of the effect his responses are having on the list of jobs that is being prepared by the machine for his consideration.

A final important feature built into the Occupational Title File is the possibility of linking automatically to other files. The only such link now existing is to the datafile of information about groups of occupations, to be described in the next section of this chapter. The two files are related in that each occupational title of the present file is an example of one of the groups listed as a record in the second file.

Thus the template for this file has the possibility of passing the user, at his option, over to a template giving information on a related topic for the other file. This link does not presently exist in the operating system, because the Occupational Groups Datafile has not yet been brought into operation. The provision for linking exists, however, and is a potentially powerful tool in the use of datafiles for the exploration of occupational alternatives.

The Occupational Title File, its preference script, and its template, all as described above, have been implemented into the working system of the ISVD, and partially tested. The file "works" in a basic sense, but displays a number of frailties that would need to be fixed if it were to be used as a working instrument in vocational counseling. Some of these needed improvements arise from technical problems, others come out of problems of gathering information, and some reflect more fundamental conceptual issues. Most could be modified, if not fixed completely, with sufficient resources, both human and machine. Most are indicative of problems arising in the construction of datafiles in general, not just this particular file of occupational titles.

1. The system does not deal gracefully with cases where information is absent from the file, but tends to say something like "A candle snuffer

can expect to make and may make as much as," instead of decently admitting "Information on the wages of a candle snuffer is not presently available." This is a technical problem and could be fixed with sufficient time in programming, It is thus a minor, though annoying, defect.

2. The preference script tends to eliminate choices from the user's list of possibilities faster than seems desirable. Often after only four or five responsive choices (other than "don't care") have been given by the user, he finds that there are no occupations that suit his specification. It may be that a larger basic stock of titles is needed in the datafile. More probably, however, this condition is a symptom of the fact that one is not free to specify <u>everything</u> about his life's work. One solution would be to limit the number of choices allowed to the user. Better would be to more fully inform and educate him about the effect of his choices by letting him go through the preference script a number of times; by letting him see how fast his choices eliminate alternatives (which the script now, in fact, does); and by providing a list of occupations that almost, but not quite, suit his specifications.

3. Alternative ways of eliminating items from a list of possible jobs need to be developed, both in response to the issue raised in item (2) above, and as a way of providing the user with a variety of ways of entering into the information made available by the datafile. In general, it is desirable not to settle on a single method of selection, but to have a number of such methods available for the user. The problem of course is that greater knowledge of the system is then

required on his part. These apparent difficulties can be turned into advantage if the system is suitably programmed, and if sufficient exposure time is possible.

4. A variety of levels of language should be linked into the templates and preference scripts, to be selected by either the user or his counselor. These should take into account both reading ability; and whether he is disposed to be massaged by the system, or simply wants to be told something in simple form.

5. Other forms of preference script, making use of variables not yet exploited, or of others not presently in the datafile, would add to the ability of the system to help an inquirer make use of occupational information. Similarly, linkages among datafiles, hinted at here in description of the Occupational Titles File, should be energetically developed.

THE OCCUPATIONAL GROUPS DATAFILE

The above section on the Occupational Titles File tells of a datafile that has been incorporated into the working system of the ISVD. Details of its contents, its templates, and its associated preference script, are therefore available through reference to the working system, and to previously issued reports of the Project.

In the present section, a second datafile of occupational information will be described. Though it has been collected on paper, transferred to magnetic tape in all but its final form, and its templates written on paper, it has not been included in the operating system of the ISVD for

lack of time. It is thus necessary to describe it more completely in this report than was the Occupational Title File, because information on it is not available elsewhere.

A second datafile of occupational information was found desirable for two separate but similar reasons. The first was a need to record information of a statistical type about numbers of workers, proportion of women or of blacks, distribution of workers among industries, and other things typically available from the United States Census -- and typically necessitating a classification scheme that covers all the workforce. Second was a need for information about the growth of numbers of workers in various occupations. Also in this case, a classification scheme was needed in which the sum total of the records of the file would represent the entire labor force. The occupational titles of the Occupational Title File do not fill this need.

So it became desirable to make a new system of classifying records, and to build a datafile around that system. The resulting system is shown in Appendix B. It is numbered according to a three digit structure, so that all occupations with the same first digit, or the same first two digits, are similar to one another. A final zero in the code number denotes miscellaneous information under the one or two digit category indicated by the first two digits. A leading zero or zeroes in the code number indicates aggregated information over the categories indicated by the numbers after the zeroes. This coding system, which sounds rather arcane when described in prose, should be clear from brief study of Appendix B. One advantage of it is that it allows branching from topic to related topic within the datafile, permitting movement to examples and to higher level groupings by mere manipulation of code numbers.

The fields of information used in the Occupational Groups Datafile are listed and briefly described in Appendix C. Full description of this datafile, its contents, and the "decode lists" needed to transfer its contents to a descriptive template, are preserved in the archives of the ISVD. 433 Characters are allowed for each record, and the bulk of these are in fact used. The information applies nationally. A similar datafile of local information would be a valuable extension, and is recommended for future development.

This datafile contains both statistical information taken mainly from the U.S. Census, 1960, and national forecasts of employment by occupation and industry. The statistical information gives particular emphasis to earnings, education, and hours worked for the entire labor force, with special data given where possible for women and black workers.

The field named "Occs II link" relates three digit and two digit record names to the two-digit and one-digit categories of which they are examples. This facilitates linking among the records of this datafile. Also provided for linking, this time with other datafiles, is coded information leading to examples in the Occupational Titles File and the Military Datafile. Examples of occupational groups at the three digit level are also provided for records at the two-digit and one-digit levels (where two-digit examples are given).

The template as written for use by the system is shown in Appendix D. The language of the template is one of those used in scriptwriting for the ISVD, and will look strange to an eye not accustomed to it. A little study should reveal the intent and structure of the template. The nomenclature "#(X)" refers to the English words decoded from the contents of the field named "X" for the record that is being described by the template.

In the case of the nine occupational groups at the one-digit level, special descriptive material was found necessary. An example of one of these "expanded descriptions" is also given in Appendix D.

The entire Occupational Groups Datafile, including decode lists and templates (but not including the material on forecasting to be described subsequently) was prepared by Lynne Fitzhugh over a period of about two months, working part time. This gives an indication of how long this sort of data-gathering and template-writing takes, when the basic source of information is readily available, compact, and well organized.

Priorities of the Project made it impossible to test this datafile in the working system. Given experience so far, it is likely that this file would have exhibited the same characteristics and deficiencies as did the Occupational Title File -- particularly a tendency to draw out explanations to rather too much length. Also, the information used here was out of date; particularly that applying to wages and to black workers. As a test of procedures, however, the experience with the Occupational Groups Datafile shows the feasibility and characteristics of use of this kind of information.

The part of the datafile that refers to forecasts was prepared as described in the Project Report entitled, "Modifying Occupational Forecasts for Individual and Local Use" by Richard Durstine and Richard Truesdell. The estimates given are national ones, based on information prepared by the Bureau of Labor Statistics. Estimates of employment in 1960 and 1975 are given, together with an annual growth rate derived from these two figures. To take into account the number of workers needed to replace those who leave the occupation (through death and retirement), an annual number

of entrants to the occupational group is estimated. High and low bounds on this estimate are given. Finally, major industries, up to six of them, employing workers in the given group, are named. Estimates of employment, growth rate, and entrants for each such occupation-industry combination are also provided.

The fields used to store the forecasting information in the Occupational Groups Datafile are listed in Appendix C. The template for delivery of the forecasts to the user is shown in Appendix E. The coded classification system used for industries is given in Appendix F. The computer programs needed to prepare the forecasts were done by Richard Truesdell.

THE MILITARY DATAFILE

The final datafile to be mentioned here, that of careers for officers and enlisted men in the military services, was prepared by Patricia Yee and Joanna Seltzer. This material was included in the operating system, but was not much tested owing to lack of demand for it by inquirers of the system.

The Military Datafile was fairly uncomplicated to prepare because of the structured manner in which the several services maintain their career data. This is more so for enlisted men than for officers, though it is relatively true in the latter case as well. The datafile has the usual form, with 170 records for enlisted men, coded fields of information, individual templates for each service, decode lists as needed to execute the templates, a preference script, and supporting information to describe the military services in general. Information about officers, being of less

structured form, is provided directly through a script rather than through a formal datafile. All aspects of the Military Datafile are discussed and illustrated in Project Report No. 23, "Description and Use of the Datafile on Military Careers" by Patricia Yee and Joanna Seltzer.

The Military Datafile is another link in the network of datafiles relating to careers. It is linked to occupational information through lists of related civilian jobs. These could be linked to the Occupational Titles File and to the Occupational Groups File, though this has not yet been done.

Like the other datafiles, the Military Datafile needs to be kept current if used with an operational system. Modifications of language would also no doubt be desirable for brevity and clarity, as well as to suit the reading skills of different users.

CHAPTER 4

POSSIBLE EXTENSIONS OF THE DATAFILES

POSSIBLE EXTENSIONS OF THE DATAFILES

Introduction

In Chapter 3, three datafiles of the ISVD were described and evaluated, in terms of their contents and of their use. This discussion applied to the historical experience and lessons of datafiles in the ISVD Project. A second viewpoint, to be taken in this chapter, suggests looking for extensions and improvements that would be feasible and desirable were the lines of thought developed by the project to be continued.

The logical sequence for development is: 1) to improve what we have; 2) to elaborate on it; 3) to create new parts consistent with what has already been done. In the making and use of datafiles, there appear three general areas of development:

1. the files themselves, in terms both of revisions of existing files and of the creation of new ones;
2. the templates, applying both to their structure and to their language;
3. entry to the information in the files, through improved preference scripts, and through linking with other files.

The discussion below will be organized according to the above three areas. Since the intent is to suggest likely directions for future development, not detailed proposals for work, these suggestions will be short.

Improvements in the Files Themselves

As to revision of the files themselves, it is only slightly too strong to suggest that the existing files be completely redone. In part this is because of their necessary obsoleteness. The Occupational Title File was prepared three years ago (1966); and many revisions and additions to its

information have become available since then, but not added to it. The Occupational Groups Datafile is based mainly on the 1960 Census of Population, so that its information on employment and earning goes back to 1959. Improvement of these files would be needed for their active use in a working system of vocational counseling. What we have now is good enough for research and developmental work. Improvements, if made, should include review: of the informational content; of the fields used to describe the information; and to a lesser extent of the records for which information is kept (the latter applies particularly to the Occupational Title File, which could benefit both from addition and perhaps removal of records).

Once improvement of any file is started, it should be kept up continuously, annually at least, to maintain currency and take advantage of new sources of information.

The structure of the occupational files is sound, and needs little modification at this time. The desirability of a file for military careers is problematical. The nature of the topic makes this an easy file to maintain in orderly condition, however. And since the military is an important part of many young lives, suitable use of information about the career training it offers is not out of place.

One important extension would be to files of specializied and local information. Specialized information -- for use by special populations, like the urban poor, or students in technical schools. Local information -- at many levels (regional, state, metropolitan), and suitably linked to information about larger geographical areas. Files of local information might well be less structured than national ones, contain different emphases, and make more use of information gathered directly rather than

from standard sources. Both statistical information and the results of interviews would be appropriate here. Updating would have to be more frequent and the information more specific, particularly if any sort of a placement function were to be served by the information in such a file. Local information was not covered in the occupational datafiles of the ISVD, beyond a partially completed attempt at local forecasts by occupation and industry, to be mentioned in Chapter 5 of this report. This is one great gap that would need considerable attention in an extension of the work of the ISVD. It would be difficult because of problems of articulation with national sources, the general shortage of good local statistics, and the need to work on a different time horizon than when dealing with national information.

There have also been suggestions for datafiles based on larger groups of occupational titles, as for example the some 14,000 specifically defined titles of the DOT. Such a datafile does in fact exist in the form of a magnetic tape prepared by the U.S. Department of Labor. Entry to the information on this tape could be made in a number of ways (in the manner of a "preference script", as described earlier). I find such a procedure questionable, given the cost. The processing needed for such a preference script would be expensive if done individually for each user of the system. Therefore, it may prove better to do extensive preliminary processing on the information in such a file, and to create a smaller file (or files) for interactive use by the ISVD. An analysis in this direction will be suggested in the next chapter.

Improvements of the Templates

The templates as they exist are but a first step in what could be a valuable set of formats for delivering information. The templates might be changed in the style or difficulty of language used, or in the level of interaction between system and inquirer (i.e., does the system ask a lot of questions, or just "tell" the user?). No single answer should be sought on these and similar issues. Instead, a set of templates is needed, to respond on call to the needs of the inquirer.

The templates could make more use of the information now in the datafiles, for example telling of the nature and location of opportunities implied by the industries in which an occupation is found. This could relate both to typical situations and to interesting aberrant cases (for example airplane pilots in the health services industry). An inquirer might find it interesting to combine the nature of his activities (defined by his occupation) with the end those activities serve (defined by the industry in which he works). For this purpose, it might prove desirable to add to the system datafiles on industries both at the national and local levels.

Similarly, templates could further discuss with the inquirer (at his option) the nature of the requirements and opportunities of a given occupation. This sort of thing has not yet been much explored, except in an abstract way. Much of it would require extensions of the datafiles, though probably a great deal could be done with the existing information.

Other Ways of Entry to the Files

Before getting information about a particular record (or records) from

a datafile -- as is done by the templates -- it is necessary to enter the datafile and to find the records that are wanted. This is the final area of extension to be discussed here of datafiles and their use.

Entry to data can be conceived in three ways: direct, if one happens to know beforehand which record he is after; through a "preference script"; and through links with other files. Only the latter two cases will be discussed here.

ENTRY THROUGH PREFERENCE SCRIPTS

The existing occupational preference script could be improved in its logic in three ways:

1. slower and better explained elimination of alternatives in reaction to the inquirer's responses to the questions put to him. This ought to be readily taken care of through more elaborate scripts.
2. various sequences for elimination of alternatives. Based on the inquirer's personal priorities, the questions put to him, and hence the sequence of elimination of possibilities, could be changed. This again depends only on more elaborate scripts.
3. provision of alternate lists of possibilities that retain choices that suit his stated preferences in all but one or two respects. This would give the inquirer more flexibility of choice, and more possibility to discuss his selections and their implications. Extra processing and storage capability is implied here. Design of this kind of improvement would need to be done in careful collaboration with those familiar with the system software.

New kinds of preference scripts could also be written. Four such new means of entry are suggested below.

1. Entry Through "Roe Groups" - The eight activity classifications (service, business contact, organization, technology, outdoor, science, general cultural, and arts and entertainment) put forth by Anne Roe in The Psychology of Occupations (1956) could (with a modest amount of coding and judgment) be linked to the existing datafiles of occupational titles or occupational groups. Classification by level of function would be a little harder, though this has been done by Professor Roe herself for some 400 occupations. Classification by activity only should be sufficient, however, for an entry to the datafiles of a kind significantly different from that we presently have.
2. Entry Through Kuder Preference Category - A modified preference script based on Kuder category was written by Lynne Fitzhugh but was not carried to implementation. In the preparation of this and similar entry scripts, a point or two has occasionally to be stretched to fit the script to the fields of the datafile. This is a limitation, but it should be a minor one if the purpose of the entry is to open up possibilities and foster exploration. Under the exploratory concept a little sloppiness of the kind ought not to be detrimental.
3. Entry Through Minnesota Occupational Rating Scales - These are coded into the existing Occupational Title File whenever possible. This mode of entry ought to be therefore easy to carry out.
4. Entry Through the "Talent Tree" - Project TALENT has developed a twelve-way tree-like classification of occupations, based on distinctions in type and level of training and on division of interest between "people"

and "technology". It should not be difficult to relate these distinctions to the Occupational Datafile, and to thus provide a link between the records in that file and the sequence of career development that TALENT has found in its researches.

ENTRY THROUGH LINKS AMONG DATAFILES

The facility for exploration provided by links among datafiles is limited mainly by persistence of the user. Datafiles should be made to include fields of information that "point to" other datafiles. This can be done in three ways: pointing to an example (an example of a biological scientist is a herpetologist); by pointing to a larger group in which a specific occupation falls (jobs similar to that of a stripper can be found in the occupational group "photoengravers"); or by simply pointing to a related case. Some provision for such linking of files is already provided. The Occupational Title File includes links to the Occupational Groups Datafile. The latter file links to enlisted military jobs, to examples in the Occupational Title File, and to higher and lower groups within itself.

Links among files have not yet been used by the scripts of the operating system. But this is a logical next step because the means to it is at hand in the files as they now exist.

CHAPTER 5

FORECASTS OF OCCUPATIONAL OPPORTUNITIES

FORECASTS OF OCCUPATIONAL OPPORTUNITIES

Summary and History

Forecasts of occupational opportunities have been an intrinsic part of datafile preparation throughout the Project. They have led to five Project Reports and Technical Memoranda, some of a highly detailed nature. The topic of forecasting has thus been the center of considerable interest and activity. Though interesting, however, guesses about the future are difficult to make in any but a general way. And it is of course impossible to know with what confidence they can be taken. It is not possible to predict the future, only to forecast it, and to allow for errors in those forecasts.

The theoretical attitudes on which our pursuit of forecasting information has been based are given by Russell Davis in Technical Memorandum No. 2, "Forecasting for Computer Aided Career Decisions: Survey of Methodology", and by Richard Durstine in Project Report No. 6, "Forecasting for Computer Aided Career Decisions: Prospects and Procedures". These, plus the fortuitous appearance of Tomorrow's Manpower Needs (TMN - 1967) from the Bureau of Labor Statistics provided the basis for most of the technical work to be discussed in this chapter. Each phase of this work has been reported in detail in other publications of the Project, so that the descriptions here will be short.

Tabular Forecasts for Inclusion in Datafiles

The information outlined in this section is described at length in a Project Report entitled "Modifying Occupational Forecasts for Individual and Local Use", by Richard Durstine and Richard Truesdell. Two major

tasks are covered in this report, both based on tabular information in TMN and on a magnetic tape of that information, supplied to ISVD by courtesy of the Bureau of Labor Statistics.

The first job was to reduce the "occupation-industry matrix" of TMN to manageable size, while keeping its most useful characteristics. This matrix gives estimates of employment in 1960 and 1975 for all combinations possible from the occupational and industrial groupings in Appendices B and F of this report. Upwards of 25,000 combinations are thus possible. Though the estimate of employment in many cases is zero, there is still more information here than the human mind can conveniently deal with.

Since the information contained in TMN is probably the most complete, detailed, and carefully thought through that is likely for some time, it was desirable to condense it into a form short enough for computer delivery as part of the ISVD operating system. For each occupation the six most important industries (if there were that many for the given occupation) were selected. The rules and details of this selection are given in the Project Report. It was thus possible to include for each record of the Occupational Groups Datafile (which records are, by conscious design, the same as those provided by TMN) the following information:

1. Estimates of total employment, and of employment in six top industries, in 1960 and 1975.
2. An indication of what part of total employment in the occupation is covered by these industries.
3. The annual rate of growth for the period 1960 to 1975, both for the total occupation and for the six major industries.
4. Two estimates of number of entrants per year to the occupation, based

on rapid and slow extrapolation of straight-line growth to 1980; and taking into account a guess of how many workers will be added through death and retirement of older workers.

Considerable guessing and approximation was sometimes needed to carry out the calculations, which sometimes required information not provided by TMN. Poor information was deemed better than none, so when a guess was necessary we made it. The upper and lower estimates of item (4) are an attempt to put limits on our guesses.

The forecasting estimates indicated here are now on magnetic tape, ready for inclusion in the Occupational Groups Datafile, and for use with template scripts such as that of Appendix E. The computer program used for these estimates has thus been tested through use, and is available for similar tasks.

The second job of tabular forecasting was to make estimates of employment by occupation and industry for a local area. This led to design of a general computer program for converting national forecasts to local forecasts. The nature of this task made it desirable to deal with only a two-digit level of classification of occupations and indistries. As a test location we used the Boston metropolitan area, though the program, once tested, could be applied to any part of the country for which proper statistics are available.

Available local statistics tend to be much less complete than national ones. This is particularly true of forecasts. The problem then is one of using what local information there is, and of fleshing it out with national information. A computer program was designed, written, and partially tested to do this in the following steps:

1. Convert 1960 local figures to a full two-digit occupation-industry matrix, using national proportions to fill in where local information is not available.
2. Make a "dummy forecast" by projecting this information as if national growth rates applied.
3. Make use of 1975 local forecasts when available (they tend to be scarce and to relate primarily to industries, not to occupations); and complete them with the aid of the dummy forecasts of item (2) above.

The above steps would give tables by occupation and industry at the two-digit level for 1960 and 1975, for the local area under consideration. On the basis of these, information on major industries, growth rates, and number of entrants could be developed in the same way (and using the same programs) as were used on the national forecasts.

The local forecasts were not completed because of lack of time, but were advanced quite far. The necessary computer programs were prepared and partially tested. Local data for 1960 and 1975 for the Boston metropolitan area were collected and put on punch cards for use with these programs. A few weeks' work with sufficient computer time ought to finish the job to the state that feasibility of the method could be affirmed or denied. If the test met with success, we would then have available a tool for statistical manipulation useful far beyond the Boston area, and in fact far beyond the topic of occupational forecasting.

Two Other Studies Based on Occupational Statistics

The work on tabular forecasts described above involved batch processing of extensive raw data to provide data suitable for use with the datafiles

of the ISVD. Two other instances of batch processing of occupational data also need mention, one of which has been completed; the second existing mainly in speculation. Neither of these is intended directly for the operating system, but both offer information of general interest to forecasting and understanding occupational information.

The first of these is reported in ISVD Technical Memorandum No. 4, "Some Workforce Requirements Implied by Current Manpower Forecasts", by Laurence Wolff, Richard Durstine, and Christopher Davis. It combines the occupational forecasts of TMN with the requirements for individual occupations given in the Dictionary of Occupational Titles. The result is estimates of requirements for training, aptitudes, temperments, physical requirements, and tolerance to working conditions, forecast to 1975. These estimates are expressed in terms of percent of the working population in 1960 and 1975. Changes in requirements are given as rate of change of number of workers to which each requirement applies; with comparison to rate of growth of the labor force as a whole.

These forecasts though highly approximate, provide some suggestions of how the dimensions of work might change in the future. Public policy, training, private enterprise, and the individual worker will all be affected by these changes. Each needs to know as much as possible about likely future demands, shortages, and opportunities. This study on forecasts of workforce requirements provides some new information in that direction.

In the above study, workforce requirements were grouped according to a factor analysis on the 41 variables available on magnetic tape about requirements of occupations (some 14,000 of them). These results could also be the first step in an analysis of groupings and occupational

requirements. Certain characteristics of jobs are highly correlated with one another. Almost surely, jobs could be effectively grouped according to a small number of primary characteristics, and other characteristics of most jobs in the group would then be fairly predictable. Three kinds of information could arise from this:

1. Most jobs could be classified into a small number of groupings, for which the salient characteristics (in terms of requirements placed on the worker) are approximately, if not completely, known. These groupings, being based on what the job requires of the worker, would be of a kind different from most that are now available. They would certainly be in much greater detail than what we now have. Linkage with information from the psychology of occupations would be facilitated.
2. A user of occupational information, once he has stated a few characteristics he has (or favors), could be given an idea of the other requirements that go along with those characteristics. An on-line computer system need not be part of this process, so that a first screening of occupational preferences could be carried out quickly on paper (and consequently at low cost).
3. Occupational titles could be found that are unusual in that they do not follow the normal pattern. These will provide occupational suggestions for those whose needs or desires are out of the ordinary.

The above program of computation has not been carried beyond the initial factor analysis. Further exploration would be needed to determine the exact sequence of sorting and computation that would be most desirable. The groundwork has been laid, however. The data are available. And the processing ought not to be overly complicated, though it might be fairly

lengthy. Once done, however, it would provide a source for occupational choice based on the total list of defined titles in the DOT; and one which would deliver considerable information without further computer processing.

A Structured Bibliography for Forecasting

Though all of our computational efforts toward occupational forecasts were based on three sources (Tomorrow's Manpower Needs and Dictionary of Occupational Titles and Census of Population, 1960), we collected and became aware of during the project a large number of sources related to forecasts of occupational information. In preparation for using these, and in realization that their number would grow, a bibliography of these sources was made. This work was done by Patricia Yee and Susan Hartman, and is described by Miss Yee in ISVD Project Report No. 21, "A Quasi-Annotated Source-list for Occupational Forecasting". The bibliography consists of two parts. The first is a list of titles (presently more than 500 of them). The second is a set of coded annotations, each taking up one 80 column punch card, giving information about the sources which might be helpful in selecting it for further attention. Included are indications of type of information, dates, occupations, industries, and localities. By simple sorting operations on these cards, those references that have the desired characteristics can be selected. This format of bibliography also allows for convenient addition and deletion of titles; and somewhat less conveniently for addition of new categories of information, should they be needed.

Concluding Remarks

Because of the technical and detailed nature of forecasting, our efforts in this direction have, during the course of the present project, been

based on information from standard sources. The main effort has been to develop techniques for use, interpretation, and processing of such information.

Time and priorities prevented any direct gathering of information, though some direct collection through interviews with workers and employers was contemplated at one time. Taped interviews could be an appealing adjunct to more formal occupational and forecasting information, particularly if carefully integrated with the operating system.

At present, the ripest possibilities for extension of activities of the ISVD in forecasting seems to be further development, test, and use of techniques for converting national to local forecasts; and the development of occupational groupings in terms of requirements, using data available from the Dictionary of Occupational Titles. Both these possibilities were discussed at some length earlier in this chapter.

APPENDICES

Appendix A

FIELDS OF INFORMATION IN THE OCCUPATIONAL TITLE FILE

FIELD	DESCRIPTION OF CONTENTS
Occupational title	identifying number and name
D.O.T. Number	six-digit number
Alternate title	up to five names and D.O.T. numbers
Entry occupations	up to four names and D.O.T. numbers
Higher occupations	up to four names and D.O.T. numbers
Related occupations	up to four names and D.O.T. numbers
Industries where found	up to four names and identifying numbers
Brief verbal description	up to 146 characters
Worker trait sector (From D.O.T.)	identifying number
Aptitudes: general intelligence	five levels
Aptitudes: verbal ability	five levels
Aptitudes: numerical ability	five levels
Aptitudes: spatial perception	five levels
Aptitudes: form perception	five levels
Aptitudes: clerical perception	five levels
Aptitudes: motor coordination	five levels
Aptitudes: finger dexterity	five levels
Aptitudes: manual dexterity	five levels
Aptitudes: eye-hand-foot coordination	five levels
Aptitudes: color discrimination	five levels
Interest preferences	up to three kinds listed
Temperament needed	up to three kinds listed
Strength required	five levels

FIELD	DESCRIPTION OF CONTENTS
Physical demands	up to five kinds found in job
Required high school courses	36 possibilities
Salaries and wages	three levels possible each for hourly, weekly, and yearly wages
Required academic ability	four levels
Required mechanical ability	four levels
Required social intelligence	four levels
Required clerical ability	four levels
Required musical ability	four levels
Required artistic ability	four levels
Required physical ability	four levels
Most common prior activity	up to two kinds of activity before entering job
On-the-job training needed	eight levels
Formal education required	eight levels
Formal education preferred	eight levels
Recommended school courses	up to four courses listed
Short training courses useful	up to two courses listed
Distribution of sexes in job	five proportions, male-female
Minimum age	age given if any
License requirement	yes, no, or sometimes
Union membership needed	usually or not
Working conditions	up to six kinds found in job
Place of work	indoor, outdoor, or both
Weekend work	weekend work never, occasionally, regularly

FIELD	DESCRIPTION OF CONTENTS
Hours of work	nightwork never, occasionally, or regularly
Travel on the job	frequently, occasionally, or never
Seasonality	seasonal fluctuations or not
Basis of income	one of four kinds
Incentives and fringe benefits	up to four kinds listed
Opportunity for promotion	four degrees
Paths for promotion	up to two kinds listed
Mobility in changing jobs	four degrees
Possibility for self-employment	yes or no
Growth rate of occupation	four levels
Demand for workers	five levels
Trend of wages	three degrees
A or an code	whether an "a" or an "an" goes with the job range
D.O.T. tape code	reference to information about job on magnetic tape related to Dictionary of Occupational Titles
BLS identification code	identifying number for reference to information about related "occupational group"
OOH reference	page reference to related information in Occupational Outlook Handbook, 1966-67 edition
Things function	worker's level of relationship with things
Data function	worker's level of relationship with data
People function	worker's level of relationship with people
Work fields	up to two examples of techniques or methods employed on the job

FIELD	DESCRIPTION OF CONTENTS
General educational development	six levels
Specific vocational preparation	nine levels
Materials involved	up to two kinds of materials, products, subjects or services dealt with on the job

Note: In all cases there is a possibility that "not applicable", "no information" or some similar null message can be coded as appropriate.

Appendix B

RECORD NAMES IN THE OCCUPATIONAL GROUPS DATAFILE

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
100	Other Professional & Technical Workers	17
101	Accountants and Auditors	3
102	Airplane Pilots and Navigators	2
103	Architects	3
104	Workers & Teachers in Arts & Entertainment	15
105	Clergymen	4
106	Designers (except Design Draftsmen)	5
107	Editors and Reporters	9
108	Lawyers and Judges	2
109	Librarians	4
111	Personnel and Labor Relations Workers	4
112	Photographers	2
113	Social and Welfare Workers	2
120	Other Engineers	9
121	Aeronautical Engineers	1
122	Chemical Engineers	1
123	Civil Engineers	3
124	Electrical Engineers	6
125	Industrial Engineers	4
126	Mechanical Engineers	3
127	Metallurgical Engineers	2
128	Mining Engineers	1

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
130	Other Natural Scientists	3
131	Chemists	4
132	Agricultural Scientists	7
133	Biological Scientists	12
134	Geologists and Geophysicists	3
135	Mathematicians	2
136	Physicists	1
140	Other Technicians	3
141	Draftsmen	1
142	Surveyors	3
143	Air Traffic Controllers	2
144	Radio Operators	3
150	Other Medical and Health Workers	10
151	Dentists	1
152	Dietitians and Nutritionists	2
153	Professional Nurses	1
155	Optometrists	1
156	Osteopaths	1
157	Pharmacists	1
158	Physicians and Surgeons	2
159	Psychologists	3
161	Medical and Dental Technicians	5
162	Veterinarians	1
170	Other Teachers	4

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
171	Elementary Teachers	1
172	Secondary Teachers	1
173	College Teachers	2
180	Other Social Scientists	5
181	Economists	2
182	Statisticians and Actuaries	4
200	Other Managers, Officials & Proprietors	40
201	Railroad Conductors	2
202	Creditmen	2
203	Ships Officers, Pilots, and Engineers	6
204	Purchasing Agents	3
205	Postmasters and Assistants	1
300	Other Clerical Workers	26
301	Accounting Clerks	3
302	Hand Bookkeepers	2
303	Bank Tellers	1
304	Cashiers	2
305	Mail Carriers	1
306	Postal Clerks	2
307	Shipping and Receiving Clerks	2
308	Telephone Operators	3
310	Stenographers, Secretaries, & Typists	6
320	Office Machine Operators	15
400	Sales Workers	29

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
500	Other Craftsmen and Foremen	91
501	Bakers	3
502	Cabinetmakers	1
503	Cranemen, Derrickmen, and Hoistmen	6
504	Glaziers	1
505	Jewelers and Watchmakers	8
506	Loom Fixers	2
508	Opticians and Lens Grinders	5
511	Log and Lumber Inspectors	1
512	Other Inspectors	1
513	Upholsterers	3
520	Other Construction Craftsmen	9
521	Carpenters	2
522	Brickmasons, Stone and Tile Setters	4
523	Cement and Concrete Finishers	3
524	Electricians	2
525	Excavating & Grading Machine Operators	8
526	Painters and Paperhangers	2
527	Plasterers	2
528	Plumbers and Pipefitters	3
529	Roofers and Slaters	1
531	Structural Metal Workers	6
540	Other Foremen	(None explicitly)
550	Other Metalworking Craftsmen (except Mechanics)	20

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
551	Skilled Machining Workers	5
552	Blacksmiths, Forgemen, and Hammermen	5
553	Boilermakers	1
554	Heat Treaters, Annealers, Temperers	1
555	Millwrights	1
556	Metal Molders (except Coremakers)	3
557	Wood and Metal Patternmakers	3
558	Rollers and Roll Hands	3
559	Sheet Metal Workers	1
561	Toolmakers, Diemakers, and Setters	2
570	Other Mechanics and Repairmen	32
571	Airplane Mechanics	2
572	Motor Vehicle Mechanics	2
573	Office Machine Servicemen	1
574	Radio and Television Mechanics	1
575	Railroad and Car Shop Mechanics	1
580	Other Printing Trades Craftsmen	4
581	Compositors and Typesetters	5
582	Electrotypers and Stereotypers	2
583	Engravers (except Photoengravers)	(None)
584	Photoengravers	7
585	Pressmen and Plate Printers	3
590	Other Transportation & Public Utility Craftsmen	10
591	Linemen and Servicemen	10

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
592	Locomotive Engineers	1
593	Locomotive Firemen	1
600	Other Semi-skilled Workers	113
601	Automobile Parking Attendants	(None)
602	Blasters and Powdermen	1
603	Laundry and Dry Cleaning Operatives	3
604	Mine Operatives and Laborers	1
605	Meatcutters (except Meatpacking)	3
606	Asbestos and Insulation Workers	1
610	Other Transportation and Public Utilities Operatives	4
611	Truck, Bus, and Tractor Drivers	4
612	Deliverymen, Routemen, and Cab Drivers	3
613	Railroad Brakemen and Switchmen	2
614	Power Station Operators	3
615	Sailors and Deckhands	(None)
620	Other Semi-skilled Metalworking Occupations	4
621	Metalworking Assemblers	8
623	Furnacemen, Smeltermen, and Pourers	3
624	Metal Heaters	5
625	Machine Tool Operators	(None)
626	Metalworking Inspectors	1
627	Welders and Flamecutters	3
628	Electroplaters	1
629	Electroplater Helpers	(None)

GROUP NUMBER	GROUP NAME	RELATED TITLES IN OCCUPATIONAL TITLE FILE
630	Other Semi-skilled Textile Occupations	5
631	Knitters, Loopers, and Toppers	7
632	Textile Spinners	1
633	Textile Weavers	1
634	Sewers and Stitchers	2
700	Other Service Workers	10
701	Airline Stewards and Stewardesses	1
702	Hospital and Other Institution Attendants	2
703	Charwomen and Cleaners	(None)
704	Janitors and Sextons	2
705	Practical Nurses	1
710	Private Household Workers	(None)
720	Other Protective Service Workers	1
721	Firemen and Fire Protection Workers	1
722	Policemen, Detectives, Marshals, & Sheriffs	3
723	Guards and Watchmen	2
730	Other Food Service Workers	1
731	Bartenders	1
732	Cooks (except Private Household)	2
733	Counter and Fountain Workers	1
734	Waiters and Waitresses	2
800	Laborers (except Farm and Mine)	(None)
900	Farmers and Farm Workers	14

Appendix C

FIELDS OF INFORMATION IN THE OCCUPATIONAL GROUPS DATAFILE

FIELD	DESCRIPTION OF CONTENTS
Group name (identification number)	three digit number
Group record name	English name of group
Sex	four coded levels, proportion of men workers
Military yes-no	two coded levels of possibility
Less than	two coded levels of relationship
Percent women	two digit number
Female, black	nine coded levels, proportion of blacks
Male, black	nine coded levels, proportion of blacks
Written description	English words, up to 146 characters
Class, male	four coded kinds of worker
Class, female	four coded kinds of worker
Percent, private industry	nine coded levels
Percent, government	nine coded levels
Percent, self employed	nine coded levels
Percent, unpaid family workers	nine coded levels
Hours, male	two digit number of hours worked
Hours, female	two digit number of hours worked
Relative hours male-female	three coded levels of relationship
Part-time yes-no	three coded levels of possibility for part-time work
Education level	seven coded levels
Relative education, male-female	three coded levels of relationship
Relative education, black	three coded levels of relationship

FIELD	DESCRIPTION OF CONTENTS
Education, black	seven coded levels
Earnings, male	five digit dollar number
Earnings, female	five digit dollar number
Relative earnings, male-female	five coded levels of relationship
Industries, male	up to three, two digit industry codes
Industries, female	up to three, two digit industry codes
Industries, non-white	up to three, two digit industry codes
Occs II link	two digit occupational group code
Misc file	three coded levels, used for logical operation of template
Job title examples	up to four, three digit codes
Examples plus	two coded levels, availability of additional examples
Military examples	up to four, four digit codes
Examples plus, military	two coded levels, availability of additional examples
Group examples	up to 18 three digit codes
HERE BEGINS THE FORECASTING FILE	
Workers 1960	five digit number of workers
Workers 1975	five digit number of workers
Growth rate sign	plus or minus
Growth rate	three digit growth rate
High entrants	four digit number of entrants
Low entrants	four digit number of entrants
Subtotal	five digit number, total of workers in top six industries
First industry name	three digit industry code
Second industry name	three digit industry code
Third industry name	three digit industry code

FIELD	DESCRIPTION OF CONTENTS
Fourth industry name	three digit industry code
Fifth industry name	three digit industry code
Sixth industry name	three digit industry code
First 1960 workers	four digit number of workers in first industry
First 1975 workers	four digit number of workers
First growth rate sign	plus or minus
First growth rate	three digit growth rate
First high entrants	three digit number of entrants
First low entrants	three digit number of entrants
Second 1960 workers	four digit number of workers in second industry
Second 1975 workers	four digit number of workers
Second growth rate sign	plus or minus
Second growth rate	three digit growth rate
Second high entrants	three digit number of entrants
Second low entrants	three digit number of entrants
Third 1960 workers	four digit number of workers in third industry
Third 1975 workers	four digit number of workers
Third growth rate sign	plus or minus
Third growth rate	three digit growth rate
Third high entrants	three digit number of entrants
Third low entrants	three digit number of entrants
Fourth 1960 workers	four digit number of workers in fourth industry
Fourth 1975 workers	four digit number of workers

FIELD	DESCRIPTION OF CONTENTS
Fourth growth rate sign	plus or minus
Fourth growth rate	three digit growth rate
Fourth high entrants	three digit number of entrants
Fourth low entrants	three digit number of entrants
Fifth 1960 workers	four digit number of workers in fifth industry
Fifth 1975 workers	four digit number of workers
Fifth growth rate sign	plus or minus
Fifth growth rate	three digit growth rate
Fifth high entrants	three digit number of entrants
Fifth low entrants	three digit number of entrants
Sixth 1960 workers	four digit number of workers in sixth industry
Sixth 1975 workers	four digit number of workers
Sixth growth rate sign	plus or minus
Sixth growth rate	three digit growth rate
Sixth high entrants	three digit number of entrants
Sixth low entrants	three digit number of entrants

Appendix D

EXAMPLE OF TEMPLATE FOR OCCUPATIONAL GROUPS DATAFILE

PART 1 - GROUP BODY FOR #(GROUP NAME)

*10.00

1.00 .IF. (First two digits of #(Group Name) are zero)/ / $(link, Expanded Description for #(Group Record Name), 5.00)/

2.00 #(Group Record Name) are #(Occs II Link).

3.00 .IF. #(Misc File)=7/ / $(Go to, No Groups Information)/

4.00 They Usually #(Written Description)

5.00 #(Sex) work in this group of occupations.

*20.00

1.00 There are several topics that may interest you. Choose from

2.00 1. Comparative opportunities for men and women

2. Earnings and education

3. Working hours

4. Industries where #(Group Record Name) work

5. Non-whites in these occupations

3.00 (keyboard)

4.00 .IF. (#(kw,1), #(Sex) = 4)/ No women work as #(Group Record Name). Choose another topic if you wish./2.00/

5.00 .IF. (#(kw,1), #(Sex) not = 4)/ / $(link, Group Sex for #(Group Name))/

6.00 .IF. #(kw,2)/ / $(link, Group Earnings and Education for #(Group Name))/

7.00 .IF. #(kw,3)/ / $(link, Group Hours for #(Group Name))/

```
 8.00   .IF. #(kw,4)/  / $(link, Group Industries for #(Group Name))/
 9.00   .IF. #(kw,5)/  / $(link, Group Black for #(Group Name))/

*30.00  $(Return)
```

PART 2 - EXPANDED DESCRIPTION FOR PROFESSIONAL - TECHNICAL WORKERS

*1.00

1.00 Professional and technical careers are attractive because they offer chances for interesting and responsible work, and may lead to high earnings. Some occupations in this field are teacher, engineer, physician, lawyer, etc.

2.00 Education and Training

Professional and technical workers require much education and training, usually a bachelor's degree and sometimes further education. Some technical jobs require only junior college, technical school training of two years, or on-the-job training. In many cases, these professions require licensing.

3.00 Employment Trends

Employment has more than doubled in the last 18 years, and is expected to rise 50 per cent in the next 10 years. Opportunities in these fields are growing rapidly.

4.00 $(Return)

PART 3 - NO GROUPS INFORMATION FOR #(GROUP NAME)

*1.00

1.00 They usually #(Written Description)

2.00 In 1960 there were about #(Workers 1960) workers in this group of occupations.

3.00 Many of them were employed in the #(Industries, Male) industries.

4.00 This is one of a few groups for which there is little specific information here.

5.00 But perhaps the system can help you find some useful information about similar occupations.

6.00 $(Return)

PART 4 - GROUP SEX FOR #(GROUP NAME)

```
      *1.00
       1.00   In 1960 there were about #(Workers 1960) #(Group Record Name)
              in the U. S.
       2.00   #(Less Than) #(Percent Women) percent were women.

      *2.00
       2.00   .IF. ((#(Class, Male) = 9) and (#(Industries, Male) = 99))/  /9.00/
       3.00   .IF. #(Class, Male) = 9)/  /7.00/
       4.00   The men were most often #(Class, Male).
       4.50   .IF. #(Class, Female) = 5/Women were also usually #(Class, Male)./  /
       5.00   .IF. #(Industries, Male) = 99/  /8.00/
       6.00   /They were employed in greatest numbers in the #(Industries, Male)
              industries./  /8.00/
       7.00   /The men were employed in greatest numbers in the #(Industries, Male)
              industries./  /
       8.00   .IF. ((#(Class, Female) = 5) and (#(Industries, Female = 43)/
              The women were also most frequently employed in these areas./*3.00/
       9.00   .IF. #(Class, Female) not = 5/The women were usually #(Class, Female)./  /
      10.00   .IF. #(Industries, Female) = 99/Unfortunately information is
              lacking on industries employing large numbers of women
              #(Group Record Name)./*3.00/
      11.00   .IF. #(Industries, Female) = 43/Women #(Group Record Name)
              were employed most often in the same industries as men./*3.00/
      12.00   Women #(Group Record Name) were employed in greatest number in
              the #(Industries, Female) industries.
```

```
*3.00
 1.00  Most men worked #(Hours, Male) hours per week or more in 1960.
 2.00  .IF. #(Hours, Female) = N/Accurate information on average hours
       worked by women is not available./*4.00/
 3.00  Women usually worked at least #(Hours, Female) hours a week.

*4.00
 1.00  Women in these occupations generally had a level of education
       #(Relative Education, Male-Female) the men.

*5.00
 1.00  .IF. #(Earnings, Female) = 9/Figures for average annual earnings
       of women in these occupations are not available./3.00/
 2.00  /Most women earned about #(Earnings, Female) dollars a year
       or more at these jobs.  That was #(Relative Earnings, Male-Female)
       than earnings for most male #(Group Record Name)./*6.00/
 3.00  .IF. #(Earnings, Male) = 9/Nor are there accurate statistics
       on the men./*6.00/

*6.00
 1.00  .IF. #(Female, Black) = 1/About #(Male, Black) of the workers
       were black.  None of them women./*7.00/
 2.00  #(Female, Black) of the women were black.  #(Male, Black) male
       workers were black.

*7.00
 1.00 $(Return)
```

PART 5 - GROUP EARNINGS AND EDUCATION FOR #(GROUP NAME)

*1.00

0.50 For 1960

1.00 Most #(Group Record Name) had at least a #(Educational Level) level of education.

2.00 .IF. #(Earnings, Male) = 9/There is, unfortunately, no information here on average earnings in this occupation./7.00/

3.00 Most men in these occupations earned #(Earnings, Male) dollars per year or more.

4.00 .IF. #(Sex) = 4/ /8.00/

5.00 .IF. #(Earnings, Female) = 9/There are no statistics here on annual earnings for women #(Group Record Name)./7.00/

6.00 /Women #(Group Record Name) earned #(Relative Earnings, Male-Female) men. They had a level of education #(Relative Education, Male-Female) men./8.00/

7.00 Women at that time usually had a level of education #(Relative Education, Male-Female) men.

8.00 Most blacks in these occupations had a level of education #(Relative Education, Black) that of the white workers.

9.00 At present there are no comparable statistics on earnings for black workers.

10.00 $(Return)

PART 6 - GROUP HOURS FOR #(GROUP NAME)

*1.00

1.00 Male #(Group Record Name) worked an average of #(Hours, Male) hours a week in 1960.

2.00 .IF. #(Sex) = 4/ /6.00/

3.00 .IF. #(Hours, Female) = N/Information is not available on hours worked by women in these occupations./6.00/

4.00 Women in these occupations worked an average of #(Hours, Female) a week.

5.00 This was #(Relative Hours, Male-Female) the men.

6.00 From the numbers who put in less than 14 hours a week in 1960, it seems that part-time work is #(Part-Time Yes-No) possible.

7.00 $(Return)

PART 7 - GROUP 1NDUSTRIES FOR #(GROUP NAME)

*1.00

1.00 In 1960, of all #(Group Record Name),

2.00 About #(Percent Private Industry) were employed in private industry.

3.00 #(Percent Government) worked for the government (including states and cities).

4.00 #(Percent Self Employed) were self-employed.

5.00 #(Percent Unpaid Family Workers) worked without pay in family businesses.

*2.00

1.00 Among male workers

2.00 They were most often #(Class, Male).

3.00 .IF. #(Industries, Male) = 99/There is no information here on the industries they worked in./*2.00/

4.00 They frequently worked in the #(Industries, Male) industries.

*3.00

1.00 .IF. #(Sex) = 4/There were no women in these occupations./*4.00/

2.00 .IF. ((#(Class, Female) = 5) and (#(Industries, Female) = 43))/ Women were usually employed in the same areas as the men./*4.00/

3.00 .IF. #(Class, Female) = 5/Women were also usually #(Class, Male),

4.00 .IF. #(Industries, Female) = 99/But no information is available on the industries employing them./*4.00/

```
5.00    .IF. #(Class, Female) = 5/But were employed most frequently in the
        #(Industries, Female) industries./*4.00/
6.00    .IF. #(Industries, Female) = 99/There is no information here on the
        industries employing women in these occupations./9.00/
7.00    .IF. #(Industries, Female) = 43/Women were most often employed in
        the same industries as the men,/9.00/
8.00    Women, however were most often employed in the #(Industries, Female)
        industries./  /
9.00    And were usually #(Class, Female)./*4.00/

*4.00

1.00    .IF. #(Industries, Non-white) = 99/Information is lacking on
        the industries employing most non-white #(Group Record Name)./*4.00/
2.00    Non-white workers were often employed in the #(Industries, Non-
        white) industries.

*4.00   $(Return)
```

PART 8 - GROUP BLACK FOR #(GROUP NAME)

```
*1.00
 1.00   In 1960
 2.00   About #(Male, Black) of all male #(Group Record Name) in the
        U. S. were blacks.
 2.00   .IF. #(Sex) = 4/  /4.00/
 3.00   #(Female, Black) of female workers were blacks.
 4.00   Most black #(Group Record Name) had at least #(Education, Black)
        education.
 5.00   Their average educational level was #(Relative Education, Black)
        that of all workers.

*2.00
 1.00   .IF. #(Industries, Black) = 99/$(Return)/
 2.00   They most often found employment in #(Industries, Black)
        industries.
 3.00   $(Return)
```

Appendix E

EXAMPLE OF TEMPLATE FOR OCCUPATIONAL FORECASTS

PART 1 - FORECAST BODY FOR #(GROUP NAME)

```
*1.00
 1.00  In 1960 #(Workers 1960,000 #(Group Record Name) were employed in
       the U. S.  By 1975 there will probably be some #(Workers 1975),000
       of them.
 2.00  .IF. #(Growth Rate) = 0/  / $(Go to, *10.00)/
       .IF. #(Growth Rate Sign) = - /  / $(Go to, *20.00)/
       .IF. #(Growth Rate Sign) = + /  / $(Go to, *30.00)/

*10.00
 1.00  Thus no great change is expected in employment in this group of
       occupations.
 2.00  Nevertheless, between (very roughly) #(Low Entrants),000 and
       #(High Entrants),000 new #(Group Record Name) are expected to
       enter the labor force each year in the near future, due to deaths
       and retirements of present workers.
 3.00  $(Go to, *40.00)

*20.00
 1.00  So there will be a drop in total number of #(Group Record Name)
       at the rate of about #(Growth Rate) percent per year.
 2.00  But this does not completely describe the demand for workers in
       these occupations.
 3.00  Because of deaths and retirements of present workers, between
```

(very roughly) #(Low Entrants),000 and #(High Entrants),000 new #(Group Record Name) are expected to enter the labor force each year in the near future.

4.00 $(Go to, *40.00)

*30.00

1.00 Hence the number of #(Group Record Name) will be increasing at the rate of about #(Growth Rate) percent per year.

2.00 As a very rough estimate, between #(Low Entrants),000 and #(High Entrants),000 new #(Group Record Name) will be entering the labor force annually in the near future.

3.00 $(Go to, *40.00)

*40.00

1.00 Of all #(Group Record Name) in the U.S. in 1975, some #(Subtotal),000 are expected to be working in the following industries:

#(First Industry)

#(Second Industry)

#(Third Industry)

#(Fourth Industry)

#(Fifth Industry)

#(Sixth Industry)

2.00 If you would like to see brief information on the opportunities for #(Group Record Name) in any of these industries, choose as you like from this list.

3.00 1. #(First Industry)

2. #(Second Industry)

```
            3.  #(Third Industry)
            4.  #(Fourth Industry)
            5.  #(Fifth Industry)
            6.  #(Sixth Industry)
4.00        (keyboard)
5.00        .IF. (kw, 1)/  / $(Set, Enth = First) and $(Link, Forecast for
            #(Group Name) and #(#(Enth) Industry)),3.00/
6.00        .IF. (kw, 2)/  / $(Set, Enth = Second) and $(Link, Forecast for
            #(Group Name) and #(#(Enth) Industry)),3.00/
7.00        .IF. (kw, 3)/  / $(Set, Enth = Third) and $(Link, Forecast for
            #(Group Name) and #(#(Enth) Industry)),3.00/
8.00        .IF. (kw, 4)/  / $(Set, Enth = Fourth) and $(Link, Forecast for
            #(Group Name) and #(#(Enth) Industry)),3.00/
9.00        .IF. (kw, 5)/  / $(Set, Enth = Fifth) and $(Link, Forecast for
            #(Group Name) and #(#(Enth) Industry)),3.00/
10.00       .IF. (kw, 6)/  / $(Set, Enth = Sixth) and $(Link, Forecast for
            #(Group Name) and #(#(Enth) Industry)),3.00/

*20.00      $(Return)
```

PART 2 - FORECAST FOR #(GROUP NAME) AND #(#(ENTH) INDUSTRY)

```
*1.00
  1.00  In 1960 #(#(Enth) Workers 1960),000 #(Group Record Name) were
        employed in #(#(Enth) Industry).  By 1975 there will probably
        be some #(#(Enth) Workers 1975),000 of them.
  2.00  .IF. #(#(Enth) Growth Rate) = 0/ / $(Go to, *10.00)/
        .IF. #(#(Enth) Growth Rate Sign) = - / / $(Go to, *20.00)/
        .IF. #(#(Enth) Growth Rate Sign) = + / / $(Go to, *30.00)/

*10.00
  1.00  Thus no great change is expected in the employment of these workers
        in these industries.
  2.00  Nevertheless (very roughly) between #(#(Enth) Low Entrants),000
        and #(#(Enth) High Entrants),000 new #(Group Record Name) might
        be expected to enter #(#(Enth) Industry) yearly in the near future.
  3.00  $(Return)

*20.00
  1.00  So there will be a drop in total number of #(Group Record Name)
        here, by about #(#(Enth) Growth Rate) percent yearly.
  2.00  Because of deaths and retirements of present workers, between
        (very roughly) #(#(Enth) Low Entrants,000 and #(#(Enth) High
        Entrants),000 new #(Group Record Name) will be needed each year
        by these industries.
  3.00  $(Return)
```

*30.00

1.00 Hence the number of #(Group Record Name) will probably increase in these industries at a rate of roughly #(#(Enth) Growth Rate) annually.

2.00 As a very rough estimate, between #(#(Enth) Low Entrants),000 and #(#(Enth) High Entrants),000 new #(Group Record Name) will be entering annually in the near future.

3.00 $(Return)

Appendix F

THREE-DIGIT INDUSTRY CODES USED FOR FORECASTS OF OCCUPATIONS AND INDUSTRIES

CODE NUMBER	INDUSTRY NAME
001	Agriculture, Forestry, Fisheries
110	Agriculture
120	Forestry
130	Fisheries
002	Mining
210	Metal Mining
220	Coal Mining
230	Crude Petroleum and Natural Gas
240	Nonmetallic Mining and Quarrying
300	Construction
004	Durable Goods Manufacturing
400	Miscellaneous Durable Goods Manufacturing
041	Lumber and Wood Products
411	Logging Camps and Contractors
412	Sawmills, Millwork, and Miscellaneous Wood Products
420	Furniture and Fixtures
043	Stone, Clay, and Glass Products
431	Glass and Glass Products
432	Cement, Concrete, and Plaster
433	Structural Clay Products
434	Pottery and Related Products
435	Miscellaneous Nonmetallic Mineral and Stone Products

CODE NUMBER	INDUSTRY NAME
044	Primary Metals Industries
441	Blast Furnaces and Steel Works
442	Other Primary Metals Industries
443	Primary Nonferrous Metals
450	Fabricated Metal Products
046	Machinery, Except Electrical
460	Miscellaneous Machinery
461	Farm Machinery and Equipment
462	Office Machinery
470	Electrical Machinery
048	Transportation Equipment
481	Motor Vehicles and Equipment
482	Aircraft and Parts
483	Ship and Boat Building
484	Railroad and Other Transportation Equipment
049	Professional and Scientific Instruments
491	Instruments Except Clocks
492	Watches and Clock Devices
005	Nondurable Goods Manufacturing
051	Food and Kindred Products
510	Other Food Products
511	Meat Products
512	Dairy Products
513	Canning, Preserving, and Freezing
514	Grain Mill Products

CODE NUMBER	INDUSTRY NAME
515	Bakery Products
516	Beverage Industries
520	Tobacco Industries
530	Textile Mill Products
540	Apparel and Related Products
055	Paper and Allied Products
550	Other Paper Products
551	Pulp, Paper, and Board Mills
552	Paperboard Containers and Boxes
560	Printing and Publishing
057	Chemicals and Allied Products
570	Other Chemicals
571	Synthetic Fibers
572	Drugs and Medicines
573	Paints, Varnishes, and Related Products
058	Petroleum Refining and Related Industries
580	Other Petroleum and Coal Products
581	Petroleum Refining
059	Rubber, Leather, and Miscellaneous Plastic Products
590	Other Rubber and Leather Products
591	Rubber Products
592	Miscellaneous Plastic Products
593	Leather Tanning and Finishing
594	Footwear Except Rubber
006	Transportation, Communication, and Public Utilities

CODE NUMBER	INDUSTRY NAME
610	Railroads
062	Local and Interurban Passenger Transportation
620	Local and Interurban Transportation Except Taxis
621	Taxis
063	Trucking and Warehousing
631	Trucking
632	Warehousing
640	Water Transportation
650	Air Transportation
660	Pipelines
670	Transportation Service
068	Communications
681	Telephone
682	Telegraph
683	Radio and Television
069	Utilities
691	Electricity, Gas, and Steam
692	Water and Irrigation
693	Sanitary Services
007	Trade
071	Wholesale Trade
710	Other Wholesale Trade
711	Motor Vehicles and Equipment
712	Drugs and Chemicals
713	Dry Goods and Apparel

CODE NUMBER	INDUSTRY NAME
714	Groceries and Related Products
715	Electrical Goods, Hardware, and Plumbing Supplies
716	Machinery and Equipment
072	Retail Trade
720	Other Retail Trade
721	Lumber, Building Supplies, and Farm Equipment
722	Limited Price Stores
723	Other General Merchandise
724	Food and Dairy Stores
725	Auto and Accessory Dealers
726	Gas Stations
727	Apparel and Accesories
728	Furniture, etc.
729	Eating and Drinking Places
731	Drug Stores
074	Finance, Insurance, and Real Estate
741	Banks and Credit Agencies
742	Stock Brokers and Investment Companies
743	Insurance
744	Real Estate
008	Services
810	Hotels and Other Lodging Places
082	Personal Services
820	Miscellaneous Personal Services
821	Laundries, Cleaners, and Valet Services

CODE NUMBER	INDUSTRY NAME
083	Miscellaneous Business Services
830	Other Miscellaneous Business Services
831	Advertising
084	Repair Services
840	Other Repair Services
841	Auto Repair
085	Entertainment and Recreation Services
850	Miscellaneous Entertainment and Recreation Services
851	Motion Pictures and Theaters
086	Professional Services
860	Other Professional Services
861	Legal Services
862	Educational Services
863	Engineering and Architectural Services
864	Accounting and Bookkeeping Services
087	Medical and Other Health Services
870	Other Medical and Health Services
871	Hospitals
088	Nonprofit Member Organizations
880	Other Nonprofit Membership Organizations
881	Welfare and Religious Organizations
890	Private Households
009	Government and Public Administration
091	Federal Public Administration
910	Other Federal Public Administration
911	Postal Service

CODE NUMBER	INDUSTRY NAME
920	State Public Administration
930	Local Public Administration

Appendix G

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